



UNISON

SOLUTIONS

Micro-Turbine Systems for Energy Production on Ag Digestion

Unison Solutions Overview

Turnkey waste-to-energy systems

Biogas compression/treatment system design and fabrication (Siloxane, moisture and H₂S removal)

Gas conditioning system components (suction scrubbers, heat exchangers, filtration, condensate knock-outs, etc.)

New line of Air and Gas drying equipment

Capstone MicroTurbine ASP and distributor (thru Alliant Energy)

STM Power Stirling Engine Generator Distributor

Multiple awards for Biogas systems (EPA project of the year 2003)

A Sampling of Unison Solutions Biogas Projects

Landfills

1. Antioch IL-12 Turbine CHP
2. Sauk Co. WI-16 Turbines
3. Glacier Ridge WI-10 Turbines
4. Wisc. Rapids WI-2000 scfm boiler direct use
5. Madison WI-1 STM Stirling Engine

WWTF/Industrial/Farm Digesters

1. Rockford IL-2.25 MW Engine CHP
2. Chippewa Falls WI-2 Turbine CHP
3. Albert Lea MN-4 Turbine CHP
4. Sheboygan WI-10 Turbine CHP
5. Northern Star Co. MN-4 Turbines
6. Top Deck Farms IA-4 Turbines

2000scfm Gas Treatment System



80scfm Gas Treatment System



Top Deck Farms

Westgate, Iowa

4-30kW Capstone Turbine System

Key Components of an Installation

Traditional plug-flow digester-750 head dairy
Gas conditioning equipment (Moisture Removal)
Gas compression system-flooded screw
Generation System-4 30kW Capstone turbines
Heat recovery system-Cain heat exchanger
Methane/LP fueled boiler
Electrical System Interconnection
Communications/Automation
Utility metering

Removing Existing Engine/Generator



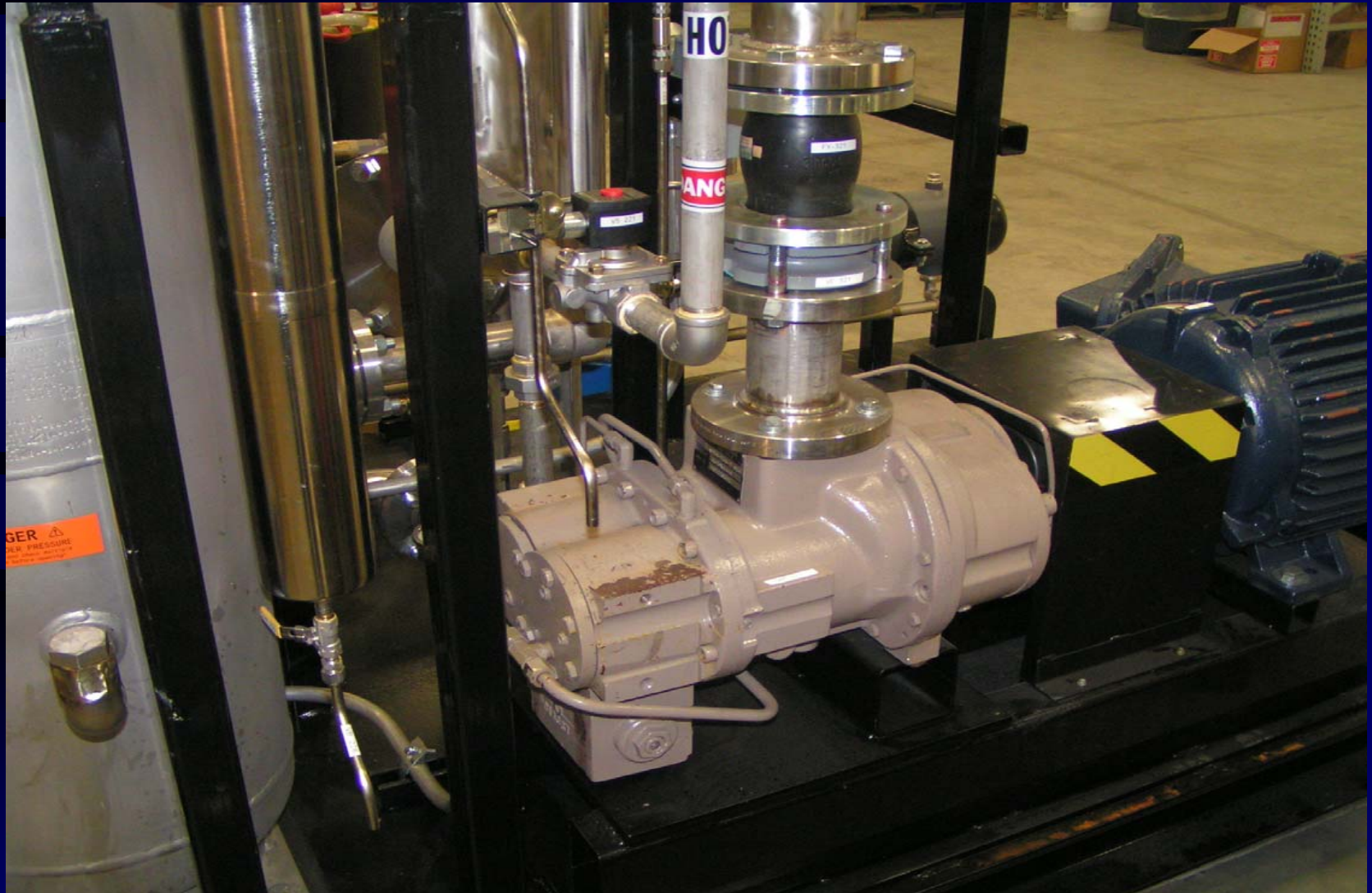
Complete Gas Conditioning System



Suction Scrubber



Flooded Screw Gas Compressor



Glycol Chiller for Moisture Removal



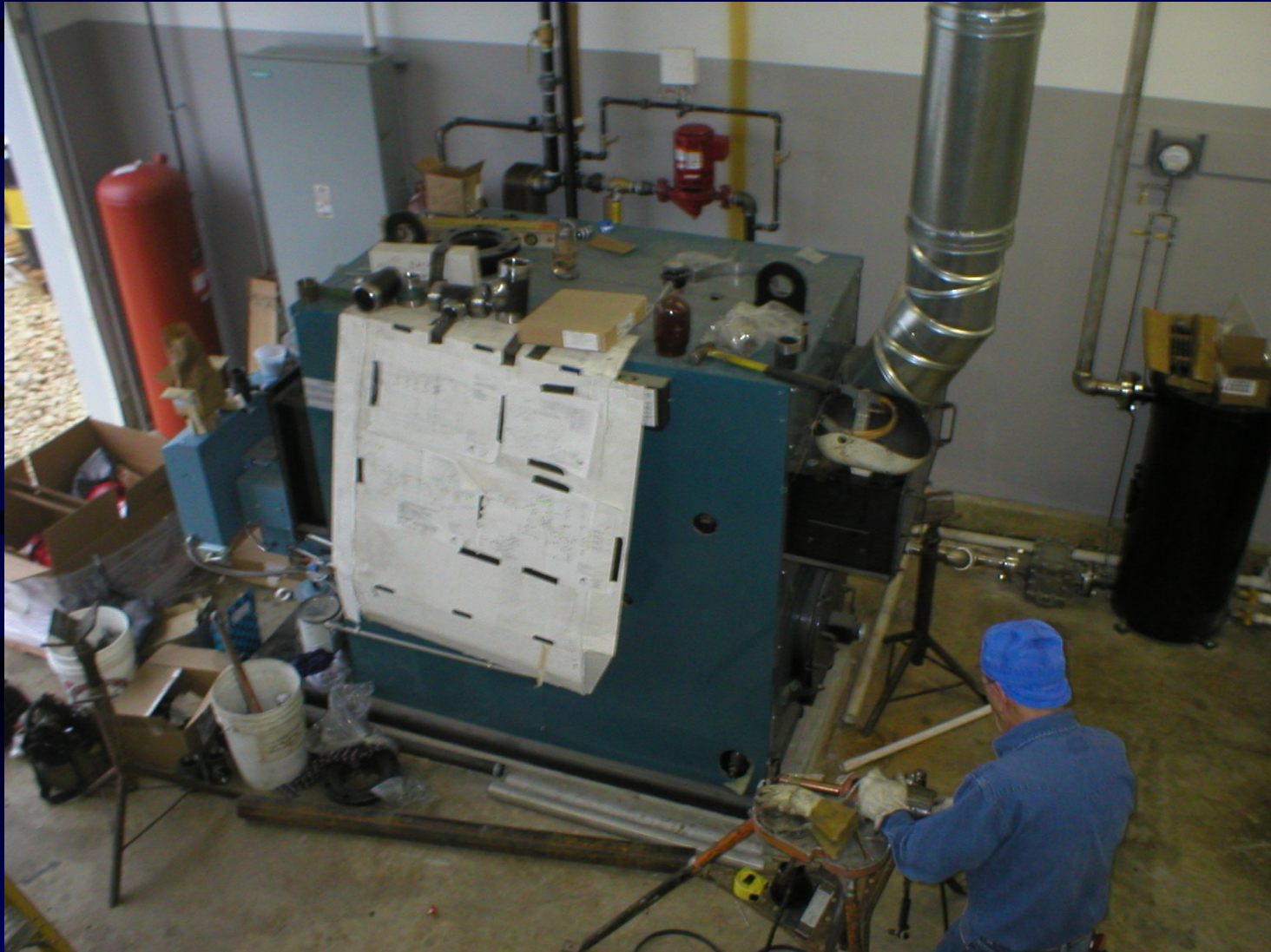
Capstone 30 kW Micro-Turbines



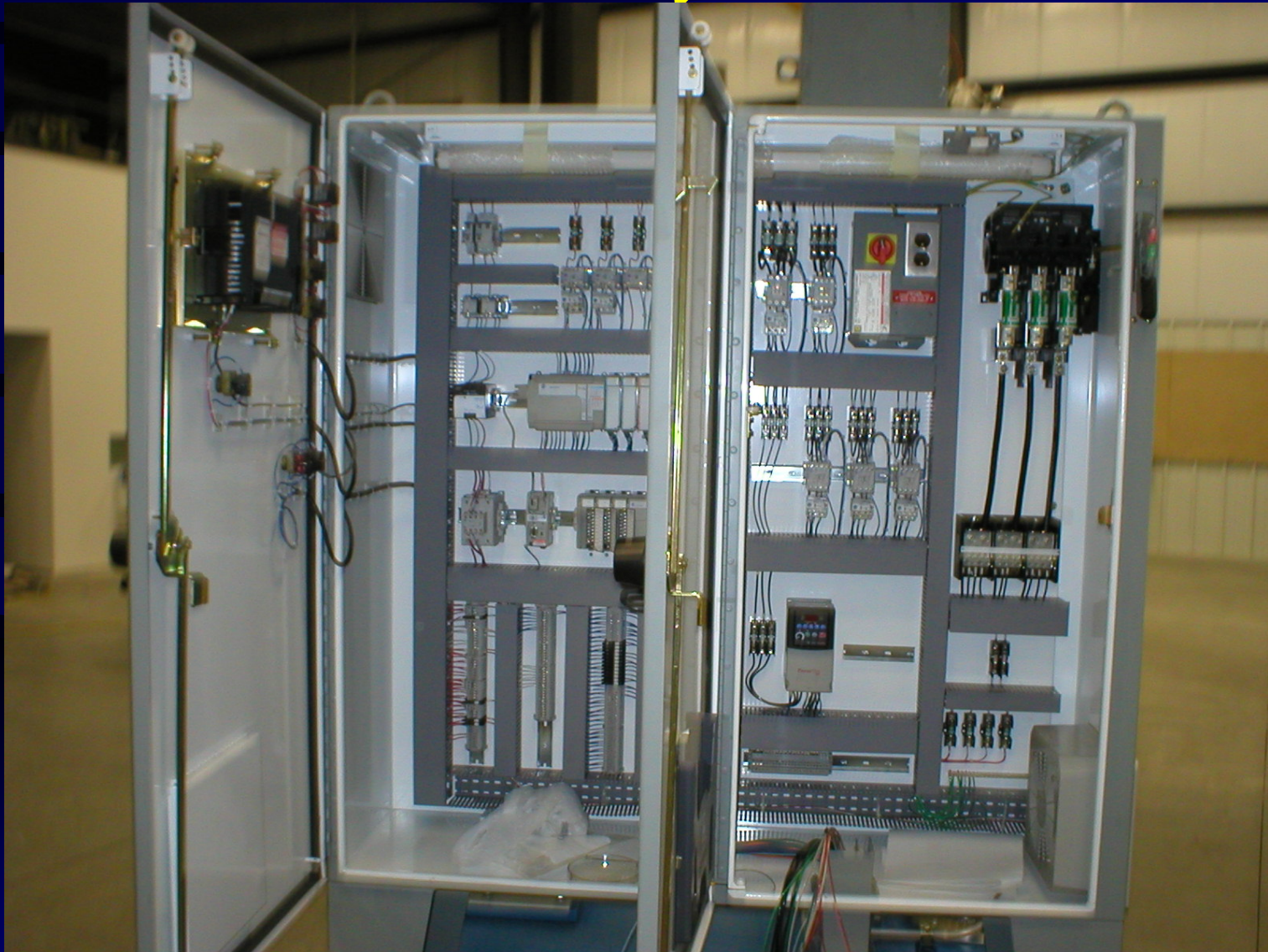
Exhaust Heat Exchanger



Methane/LP Boiler



Controls for all System Functions



Top Deck Project Overview

Approx. 1 year of operation since IC engine/generator removed

Biogas compression/treatment system is removing the moisture from the gas and protecting the turbines

Parasitic load on system for biogas compression and treatment is 16%

Installation cost of \$3,000/kW

O&M cost is running \$0.01/kWh or \$9900/year

Biggest challenge has been the dual fuel gas train on the boiler

Key Issues with Micro-Turbines on Ag Digester

Ag digester fueled micro-turbine systems need gas conditioning for moisture removal.

Micro-turbine systems also need gas compression to 80psi.

Large quantity of thermal energy is available for heating the digester, domestic hot water and space heating with a proper heat recovery system.

Turbine and gas treatment O&M expense is minimal if the system is designed and built properly.

Micro-turbines are a viable option for Ag digester fueled combined heat and power systems

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